



10/733858

c ofc

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of: Zhu et al.

Attorney Docket No.: NOVLP090

Patent: 7,163,896 B1

Issued: January 16, 2007

Title: BIASED H2 ETCH PROCESS IN
DEPOSITION-ETCH-DEPOSITION GAP FILL

CERTIFICATE OF MAILING

I hereby certify that this correspondence is being deposited with the U.S. Postal Service with sufficient postage as first class mail on August 16, 2007 in an envelope addressed to the Commissioner for Patents, P.O. Box 1450 Alexandria, VA 22313-1450.

Signed: _____

Aurelia M. Sanchez

**REQUEST FOR CERTIFICATE OF CORRECTION
OF OFFICE MISTAKE
(35 U.S.C. §254, 37 CFR §1.322)**

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450
Attn: Certificate of Correction

**Certificate
AUG 23 2007
of Correction**

Dear Sir:

Attached is Form PTO-1050 (Certificate of Correction) at least one copy of which is suitable for printing. The errors together with the exact page and line number where the errors are shown correctly in the application file are as follows:

COVER PAGE:

1. In the (75) Inventors section, change "Pingsheng, Sun" to --Pinsheng, Sun--. This appears correctly in the Corrected Filing Receipt as mailed on April 28, 2004.

SPECIFICATION:

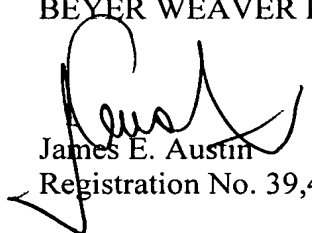
1. Column 7, line 57, change "2000" to --200--. This appears correctly in the patent application as filed on December 10, 2003 on page 12, line 5.

AUG 23 2007

Patentee hereby requests expedited issuance of the Certificate of Correction because the error lies with the Office and because the error is clearly disclosed in the records of the Office. As required for expedited issuance, enclosed is documentation that unequivocally supports the patentee's assertion without needing reference to the patent file wrapper.

It is noted that the above-identified errors were printing errors that apparently occurred during the printing process. Accordingly, it is believed that no fees are due in connection with the filing of this Request for Certificate of Correction. However, if it is determined that any fees are due, the Commissioner is hereby authorized to charge such fees to Deposit Account 50-0388 (Order No. NOVLP090).

Respectfully submitted,
BEYER WEAVER LLP



James E. Austin
Registration No. 39,489

P.O. Box 70250
Oakland, CA 94612-0250
408-255-8001

AUG 23 2007



UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

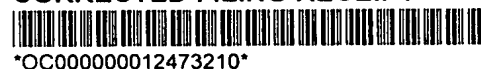
APPL NO.	FILING OR 371 (c) DATE	ART UNIT	FIL FEE REC'D	ATTY. DOCKET NO	DRAWINGS	TOT CLMS	IND CLMS
10/733,858	12/10/2003	2812	900	NOVLP090/NVLS002888	6	20	2

CONFIRMATION NO. 7860

022434

BEYER WEAVER & THOMAS LLP
P.O. BOX 778
BERKELEY, CA 94704-0778

CORRECTED FILING RECEIPT



OC000000012473210

Date Mailed: 04/28/2004

Receipt is acknowledged of this regular Patent Application. It will be considered in its order and you will be notified as to the results of the examination. Be sure to provide the U.S. APPLICATION NUMBER, FILING DATE, NAME OF APPLICANT, and TITLE OF INVENTION when inquiring about this application. Fees transmitted by check or draft are subject to collection. Please verify the accuracy of the data presented on this receipt. **If an error is noted on this Filing Receipt, please write to the Office of Initial Patent Examination's Filing Receipt Corrections, facsimile number 703-746-9195. Please provide a copy of this Filing Receipt with the changes noted thereon. If you received a "Notice to File Missing Parts" for this application, please submit any corrections to this Filing Receipt with your reply to the Notice. When the USPTO processes the reply to the Notice, the USPTO will generate another Filing Receipt incorporating the requested corrections (if appropriate).**

Applicant(s)

Wenxian Zhu, Palo Alto, CA;
Jengyi Yu, San Jose, CA;
Siswanto Sutanto, San Jose, CA;
Pinsheng Sun, San Jose, CA;
Jeffrey Chih-Hou Lowe, Milpitas, CA;
Waikit Fung, Cupertino, CA;
Tze Wing Poon, Sunnyvale, CA;

Assignment For Published Patent Application

Novellus Systems, Inc.;

Domestic Priority data as claimed by applicant**Foreign Applications**

If Required, Foreign Filing License Granted: 03/17/2004

Projected Publication Date: Request for Non-Publication Acknowledged

Non-Publication Request: Yes

Early Publication Request: No



JANIEA

AUG 23 2007

Title

Biased H2 etch process in deposition-etch-deposition gap fill

Preliminary Class

438

**LICENSE FOR FOREIGN FILING UNDER
Title 35, United States Code, Section 184
Title 37, Code of Federal Regulations, 5.11 & 5.15**

GRANTED

The applicant has been granted a license under 35 U.S.C. 184, if the phrase "IF REQUIRED, FOREIGN FILING LICENSE GRANTED" followed by a date appears on this form. Such licenses are issued in all applications where the conditions for issuance of a license have been met, regardless of whether or not a license may be required as set forth in 37 CFR 5.15. The scope and limitations of this license are set forth in 37 CFR 5.15(a) unless an earlier license has been issued under 37 CFR 5.15(b). The license is subject to revocation upon written notification. The date indicated is the effective date of the license, unless an earlier license of similar scope has been granted under 37 CFR 5.13 or 5.14.

This license is to be retained by the licensee and may be used at any time on or after the effective date thereof unless it is revoked. This license is automatically transferred to any related applications(s) filed under 37 CFR 1.53(d). This license is not retroactive.

The grant of a license does not in any way lessen the responsibility of a licensee for the security of the subject matter as imposed by any Government contract or the provisions of existing laws relating to espionage and the national security or the export of technical data. Licensees should apprise themselves of current regulations especially with respect to certain countries, of other agencies, particularly the Office of Defense Trade Controls, Department of State (with respect to Arms, Munitions and Implements of War (22 CFR 121-128)); the Office of Export Administration, Department of Commerce (15 CFR 370.10 (j)); the Office of Foreign Assets Control, Department of Treasury (31 CFR Parts 500+) and the Department of Energy.

NOT GRANTED

No license under 35 U.S.C. 184 has been granted at this time, if the phrase "IF REQUIRED, FOREIGN FILING LICENSE GRANTED" DOES NOT appear on this form. Applicant may still petition for a license under 37 CFR 5.12, if a license is desired before the expiration of 6 months from the filing date of the application. If 6 months has lapsed from the filing date of this application and the licensee has not received any indication of a secrecy order under 35 U.S.C. 181, the licensee may foreign file the application pursuant to 37 CFR 5.15(b).

AUG 23 2007

the biased H₂ etch-enhanced gap fill process noted below showing that there is only trace amount of C (30ppm), N (20ppm) and F (10ppm) contained in the film relative to the SiO₂ film density of 7E+22 atoms/cc.

Biased H₂-Etch Enhanced deposition conditions for SIMS analysis sample

5

Parameter	Deposition 1	Etch	Deposition 2
Wafer temp (°C)	550	650	650
SiH ₄ (sccm)	80		80
H ₂ (sccm)	100	800	100
He (sccm)	200	300	200
O ₂ (sccm)	110	0	110
Pressure (mTorr)	2.5	7.0	2.5
Bias (HF RF) Power (W)	1100	3000	3100
Source (LF) Power (W)	3000	4000	3000

In addition, application of bias power to the wafer leads more etching radicals to move towards the etched target (wafer) so that etch back is enhanced. As shown in Fig. 3, etch rate increases with increase of the bias power.

10 Another advantageous characteristic of the biased H₂ etch-enhanced gap fill process of the invention is that etch-induced bottom-up deposition loss is minimum. This is illustrated in Fig. 4 which depicts etch amount inside and outside of a trench vs. etch time. Thus, as previously illustrated in Fig. 1, biased H₂ etch back of deposition on the trench top (overhang and top-hat) is much faster than that inside the
15 trench. This is desirable to minimize gap fill deposition loss during the etch stage of the multi-step process. Secondly, etch amount of deposition on the trench top increases with time, while it remains unchanged for the bottom-up gap fill at the normalized time ≥ 1.0 .

20 Thus, this invention provides an etch-enhanced HDP gap fill (e.g., STI) process with an *in situ* high throughput H₂ etch step without C, N and F contamination.

Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB Control number

(Also Form PT-1050)

UNITED STATES PATENT AND TRADEMARK OFFICE CERTIFICATE OF CORRECTION

PATENT NO. : 7,163,896 B1

Page 1 of 1

DATED : January 16, 2007

INVENTOR(S) : Zhu et al.

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

In the Cover Page:

In the (75) Inventors section, change "Pingsheng, Sun" to --Pinsheng, Sun--.

In the Specification:

Column 7, line 57, change "2000" to --200--.

MAILING ADDRESS OF SENDER:

PATENT NO. 7,163,896 B1

James E. Austin
BEYER WEAVER LLP
P.O. Box 70250
Oakland, CA 94612-0250

No. of Additional Copies

1

Burden Hour Statement: This form is estimated to take 1.0 hour to complete. Time will vary depending upon the needs of the individual case. Any comments on the amount of time you are required to complete this form should be sent to the Chief Information Officer Patent and Trademark Office, Washington, DC 20231. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Assistant Commissioner for Patents, Washington, DC 20231.

1/16/07